MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL AVIATION UNIVERSITY
FACULTY OF ENVIRONMENTAL SAFETY,
ENGINEERING AND TECHNOLOGIES
DEPARTMENT OF ECOLOGY

APPROVED TO DEFENCE
Head of the Graduate Department
_____ V.F. Frolov
«_____» _____ 2020

BACHELOR THESIS

(EXPLANATORY NOTE)

SPECIALTY 101 «ECOLOGY»,
TRAINING PROFESSIONAL PROGRAM
"ECOLOGY AND ENVIRONMENTAL PROTECTION"

Theme: «Analysis of nature protecting activity of the Ukrainian airports»

Done by: student of the FESET – EK-402 group, Maryna A. Mushta
(student, group, surname, name, patronymic)

Scientific Supervisor: Ph. D. in Eng., Associate Professor of the Ecology Department, Marharyta M. Radomska
(academic degree, academic rank, surname, name, patronymic)

Standards Inspector: _____ Andrian A. Iavniuk
(signature) (S.N.P)

KYIV 2020

МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
НАЦІОНАЛЬНИЙ АВІАЦІЙНИЙ УНІВЕРСИТЕТ
ФАКУЛЬТЕТ ЕКОЛОГІЧНОЇ БЕЗПЕКИ,
ІНЖЕНЕРІЇ ТА ТЕХНОЛОГІЙ
КАФЕДРА ЕКОЛОГІЇ

ДОПУСТИТИ ДО ЗАХИСТУ
Завідувач випускової кафедри
_____ В.Ф. Фролов
«_____» _____ 2020 р.

ДИПЛОМНА РОБОТА

(ПОЯСНЮВАЛЬНА ЗАПИСКА)

ВИПУСКНИКА ОСВІТНЬОГО СТУПЕНЯ БАКАЛАВРА

ЗА СПЕЦІАЛЬНІСТЮ 101 «ЕКОЛОГІЯ»
ОПП «ЕКОЛОГІЯ ТА ОХОРОНА НАВКОЛИШНЬОГО СЕРЕДОВИЩА»

Тема: «Аналіз природоохоронної діяльності аеропортів України»

Виконавець: студентка групи ЕК- 402, Мушта Марина Анлріївна
(студент, група, прізвище, ім'я, по батькові)

Керівник: канд.техн.наук, доцент кафедри екології Радомська Маргарита Мирославівна
(науковий ступінь, вчене звання, прізвище, ім'я, по батькові)

Нормоконтролер: _____ Явнюк А. А.
(підпис) (П.І.Б.)

КИЇВ 2020

NATIONAL AVIATION UNIVERSITY

Faculty of Environmental Safety, Engineering and Technologies

Department of Ecology

Specialty, training professional program: specialty 101 «Ecology», Training Professional Program "Ecology and Environmental Protection"

(code, name)

APPROVED
Head of the Department
_____ Frolov V.F.
«____» _____ 20__

BACHELOR THESIS ASSIGNMENT

Maryna A. Mushta

1. Theme: «Analysis of nature protecting activity of the Ukrainian airports» approved by the Rector on 27.04.2020, № 527/ст.

2. Duration of work: from 25.05.2019 to 21.06.2020.

3. Output work (project): airport sites; environmental policy; environmental reports; conclusions of impact on the environment; notifications of planned activities; environmental impact statement; the strategic plans for the development of the airports; environmental safety rules; management reports; comprehensive environmental programs; reports on the strategic environmental assessment; reports on the natural environments state in the regions; statements of environmental consequences; statements of environmental effect; environmental impact assessment reports; inspection portal; state aviation administration of ukraine; state ecological inspectorate of ukraine.

4. Content of explanatory note: Analytical review of the literature on the topic of the diploma. The assessment of hazardous impacts of Ukrainian airports activities. Recommendations on the improvement of environmental activities and environmental policy at airports.

5. The list of mandatory graphic (illustrated materials): tables, figures.

6. Schedule of thesis fulfillment

№ з/п	Task	Term	Advisor's signature
1	Obtaining the topic of the task, searching for literature sources and analysis of previous research	25.05.2020-26.05.2020	
2	Writing a review of the problem on the topic of the study (Chapter I)	27.05-28.05	
3	Choice of research methodology (Chapter II)	29.05-30.05	
4	Conducting experimental research	31.05-01.06	
5	Formulation of conclusions and recommendations of qualification work	02.06-03.06	
6	Registration of the explanatory note to the preliminary representation at department, consultation with the normcontroller	04.06-05.06	
7	Preliminary defense	05.06-07.06	
8	Taking into account comments, recommendations and preparation for defense	08.06-16.06	
9	Presentation of work to the department	12.06.2020	
10	Defense of qualification work	17.06.2020	

7. Date of task issue: «27» April 2020

Diploma (project) advisor: _____ _Radomska M.M.
(advisor's signature) (S.N.P.)

Task is taken to perform: _____ _____
(graduate's signature) (S.N.P.)

НАЦІОНАЛЬНИЙ АВІАЦІЙНИЙ УНІВЕРСИТЕТ

Факультет екологічної безпеки, інженерії та технологій

Кафедра екології

Спеціальність, освітньо-професійна програма: спеціальність 101 «Екологія», ОПП «Екологія та охорона навколишнього середовища»

(шифр, найменування)

ЗАТВЕРДЖУЮ
Завідувач кафедри
_____Фролов В.Ф.
«____» _____ 20__ р.

ЗАВДАННЯ
на виконання дипломної роботи
Мушта Марина Андріївна

1. Тема роботи «Аналіз природоохоронної діяльності аеропортів України» затверджена наказом ректора від «27» квітня 2020 р. №527/ст.

2. Термін виконання роботи: з 25.05.2020 р. по 21.06.2020 р.

3. Вихідні дані роботи: сайти аеропортів; екологічна політика; екологічні звіти; висновки впливу на навколишнє середовище; повідомлення про заплановані заходи; заяви про вплив на навколишнє середовище; стратегічні плани розвитку аеропортів; правила екологічної безпеки; звіти керівництва; комплексні екологічні програми; звіти про стратегічну екологічну оцінку; звіти про стан природного середовища в регіонах; заяви про екологічні наслідки; звіти про оцінку впливу на навколишнє середовище; інформація з сайту Державного авіаційного управління України, інспекційного порталу та державної екологічної інспекції України.

4. Зміст пояснювальної записки: Аналітичний огляд літератури за темою диплома. Оцінка небезпечного впливу діяльності аеропортів України. Рекомендації щодо вдосконалення природоохоронної діяльності та екологічної політики в аеропортах.

5. Перелік обов’язкового графічного (ілюстративного) матеріалу: таблиці, рисунки.

6. Календарний план-графік

№ з/п	Завдання	Термін виконання	Підпис керівника
1	Отримання теми завдання, пошук літературних джерел та аналіз попередніх досліджень	25.05.2020-26.05.2020	
2	Написання огляду проблеми за темою дослідження (Розділ І)	27.05-28.05	
3	Вибір методики дослідження (Розділ ІІ)	29.05-30.05	
4	Проведення експериментальних досліджень	31.05-01.06	
5	Формулювання висновків та рекомендацій кваліфікаційної роботи	02.06-03.06	
6	Оформлення пояснювальної записки до попереднього представлення на кафедрі, консультація з нормоконтролером	04.06-05.06	
7	Попередній захист	05.06-07.06	
8	Урахування зауважень, рекомендацій та підготовка до захисту	08.06-16.06	
9	Представлення роботи на кафедру	12.06.2020	
10	Захист кваліфікаційної роботи	17.06.2020	

7. Дата видачі завдання: «27» Квітня 2020 р.

Керівник дипломної роботи (проекту): _____ Радомська М. М.
(підпис керівника) (П.І.Б.)

Завдання прийняв до виконання: _____ _____
(підпис випускника) (П.І.Б.)

ABSTRACT

Explanatory note to thesis «Analysis of environmental activities of Ukrainian airports»: 63 pages, 1 figures, 5 tables, 45 references.

Object of research – the formation of environment pollution due to airports activities.

Subject of research – management of environment protection activities at Ukrainian airports.

Aim of the work – to analyze the environmental performance of Ukrainian airports.

Methods of research: search, analysis and synthesis of information, comparative analysis, visual observations of maps.

AIRPORT, ENVIRONMENTAL POLICY, ENVIRONMENTAL PERFORMANCE, ENVIRONMENTAL IMPACTS, NATURE PROTECTING ACTIVITY

CONTENT

LIST OF SYMBOLIC NOTATIONS, ABBREVIATIONS AND NOTIONS

UHF – Ultra High Frequency;

ICAO – International Civil Aviation Organization;

KBP - Code of Boryspil International Airport;

IATA – International Air Transport Association;

ACI – Airports Council International;

SE – State Enterprise;

ISO – International Organization for Standardization;

IA – International Airport;

LED – Light-emitting diode;

NAMS – National Academy of Medical Sciences of Ukraine;

CIS – Commonwealth of Independent States;

EA – Environmental Aspects;

MES – Ministry of Emergency Situations of Ukraine;

EMF – Electromagnetic field.

INTRODUCTION

Relevance of the work: Nowadays, air transportation is an integral part of many people's lives. This is a very fast and safe way to move. The more developed the tourism and economic industries, the greater the demand for air transport. Therefore, now the airport system is developing very rapidly. Like any transport component, the airport has an impact on the environment, both locally and globally. Airports are often on the border with cities and towns, thus affecting people's lives and health. Ukraine has a well-developed aviation industry, but despite this, the impact on the environment is not given as much attention as needed. Airport environmental policy / activity is an area that needs constant monitoring and improvement. The study and analysis of the environmental performance of airports is needed in order to identify "weaknesses" in eco-policy / environmental protection, find ways to solve these problems and minimize the impact on the environment.

Aim and tasks of the diploma work.

Aim of the work – to analyze the environmental performance of Ukrainian airports.

Tasks of the work:

1. To analyze the general characteristics of airports (technological structure and economic value);
2. To identify the main sources of environmental impacts on the territory of the airports;
3. To investigate the influence of airports on biotic and abiotic components;
4. To analyze the environmental policy of airports of Ukraine;
5. To study the environment protection activity of Ukrainian airports;
6. To define the environmental issues of Ukrainian airports;
7. To develop recommendations on the improvement of environmental activities and environmental policy at airports.

Object of research – the formation of environment pollution due to airports activities.

Subject of research is management of environment protection activities at Ukrainian airports.

Methods of research **–** search, analysis and synthesis of information, comparative analysis, visual observations of maps.

Personal contribution of the graduate: research and analysis of literature, research of ecological problems of airports of Ukraine, creation of recommendations and determination of the level of ecological efficiency of airports of Ukraine.

Approbation of results. The main content and conclusions of the thesis are presented in the discussion in 2 international conferences: VII International Scientific Conference of Young Scientists and XX International Scientific and Practical Conference "Flight. Modern Problems of Science".

Publications. Thesis materials are published in publications based on conference proceedings and abstracts.

CHAPTER 1
AIRPORTS AS OBJECTS OF ENVIRONMENTAL IMPACT

1.1. General characteristics of airports (technological structure and economic value)

The airport is a complex of engineering structures designed for the dispatch, acceptance and technical maintenance of air transport, as well as passenger and cargo services. Modern airports of world importance are very complex engineering and technical facilities, full of modern equipment. The airport includes:

- an aerodrome (the main part of the airport, which includes a runway), it should be solid (ground, concrete, etc.) or water;
- service and technical territory with an air terminal;
- aircraft maintenance facilities (enterprises where repairs of aircraft and helicopters are carried out), service and technical area with hangars;
- fuel and lubricants depot.

Airport is an aerodrome with expanded capabilities, which is used most for commercial air transport. Airports often have dispatching towers, as well as premises for servicing and storing aircraft. Also, the airport includes a landing area with open space. There are several other types of airports: which exclusively serves helicopters and the base of seaplanes (for the use of seaplane and amphibian aircraft). Such a base usually contains a section of open water for take-off and landing, and other equipment for seaplanes.

Larger airports (with predominantly asphalted runways of 2,000 m long) can have air traffic control centers, bridges over runways, platform and passenger facilities (restaurants and salons, as well as emergency services). The international airport contains all the components and has additional facilities for passport and customs control [1].

So, all the airport facilities should work in the complex. Flight safety, reliability, regularity, and quality of passenger and cargo service depend on the coherence of their actions [2].

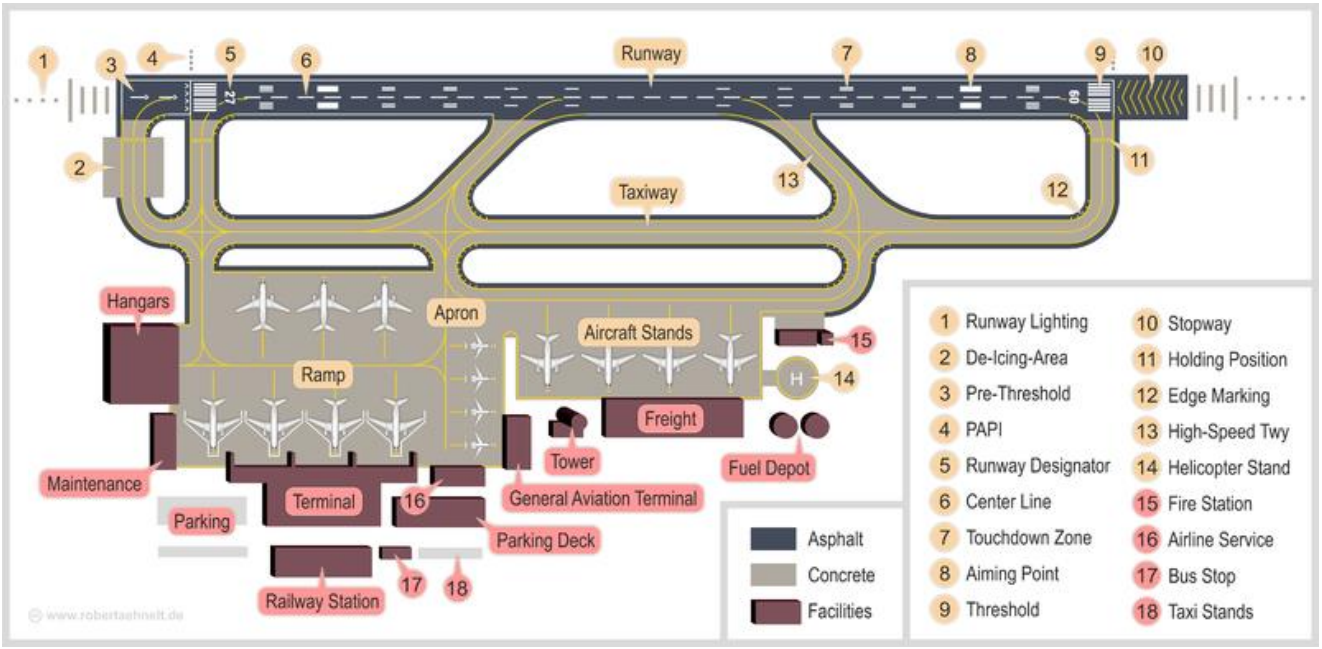

Fig.1.1 Sample infrastructure of a typical airport [3]

The main purpose of the airport's activity is to provide air transport on international and domestic airlines. For this the airport carries out:

1. Departure and reception of aircraft;
2. Air navigation services for airplanes;
3. Maintenance;
4. Commercial service of passengers and cargo handling taking into account the requirements of the government and instructions;
5. Conservation of goods;
6. Sale and booking of airline tickets;
7. Additional services for passengers;
8. Reception of aircrafts and crews of airlines for permanent and temporary base.

Some activities of the airport are performed jointly and on the basis of agreements concluded with national and foreign legal entities or individuals, with the obligatory agreement of each of them in the manner established by the legislation of the state:

1. Organization of food and consumer services, as well as hotel activities;
2. All kinds of excursion service and tourism;
3. Lease of property, inventory, equipment, household appliances, etc.;
4. Design, construction, exploitation, repair and lease of objects of production

and non-production purposes;

5. Organization of passenger, cargo transportation by own means of leased transport of all types (ground, water) both in the country and abroad, as well as providing forwarding services;

6. Teaching activities and training / retraining courses;

7. Provision of legal, consulting, marketing, engineering services and development, implementation of software products [4].

Air transport is the fastest growing transport network in the world. It is necessary for tourism, trade, business, and economic growth in general. 120,000 flights depart every day (12 million passengers and 18.8 billion dollars of world trade).

Thanks to the aviation industry, there are about 65 million jobs worldwide:

Approximately 10 million direct jobs:

- airport operators: 524 thousand;
- nearly 6 million (car rental, customs and immigration, retail and catering);
- airlines: almost 3 million (pilots, flight attendants, ground services, attendants);
- approximately 232 thousand people at Air Navigation Services - traffic controllers).

These jobs are approximately 4 times more productive than average jobs in the economy.

Approximately 11 million indirect jobs: These include suppliers for the air transport industry (for example, construction companies, fuel suppliers, product manufacturers, aviation component suppliers). It also includes various business support services, such as information technology, call centers, accounting.

Also, tourism plays a large role in providing jobs (approximately 36.7 million jobs). Tourism is developing rapidly, thus meeting the need for air transport.

And given that the aviation industry has relatively high salaries, workers contribute to the domestic economy. Their purchasing power supports jobs in retail, consumer goods, and in various service industries, such as banks and restaurants [5].

For economic reasons, there is an intensive commercial activity at airports, which leads to an additional organization of food and auxiliary services for passengers. For this activity, up to 50% of the building's area can be used in separate harbors [6].

Given the fact that the airport has a rather large impact on the domestic economy of many countries and the global economy as a whole, projects on the development of the aviation industry are being introduced at the legislative level. This can be seen on the example of our country - Resolution №. 126 of February 24, 2016 "On Approval of the State Target Program for the Development of Airports for the Period until 2023" [7].

1.2. The main sources of environmental impacts on the territory of the airports

Airplanes move from one airport to another during the flight, and so the environment is polluted on a global scale, that is, significant pollution occurs both on the routes and in the airports. Moreover, if on the routes of flight (at the altitude of 8-12 km) the danger from this pollution is small (as the flights at high altitude and at high speed cause the scattering of combustion products in the upper atmosphere and in large areas, which reduces the degree of their impact on living organisms), then in the airport area, such pollution can be a great danger [8].

The top aims of environmental protection from the influence of aviation (airports) are:

- pollution of atmospheric air, soils, water objects due to emissions of harmful substances from aircraft engines, pedal vehicles and stationary sources;
- noise pollution;
- electromagnetic pollution;
- thermal pollution;
- inappropriate planning and organization of land use;
- negative impact on the environment when transporting hazardous and radioactive substances, including accidental pollution due to the use of poor-quality, outdated equipment [9, 10].

The origin of these impacts is in the equipment and processes involved in the provision of air transportation and passenger services (Table 1.2). Thus, it should be concluded that airports on the whole are sources of environmental hazards and must undergo certain control.

Table 1.2

The main sources of environmental impact on the territory of the airports

№	Source	Pollution
1	Motors (aircraft)	noise; pollution of atmospheric air, soils, water objects due to emissions of harmful substances; vibration; thermal pollution
2	Pedal cars	noise; pollution of atmospheric air, soils, water objects due to emissions of harmful substances; vibration; thermal pollution
3	Using of chemicals (used for sinks, icing, etc)	pollution of soils, water objects (and sometimes pollution of atmospheric air)
4	Radio navigation equipment of airports and aircrafts	electromagnetic pollution
5	Accidents (at oil depots at airports, due to the use of poor-quality, outdated equipment, due to transporting hazardous and radioactive substances, etc.)	pollution of atmospheric air, soils, water objects due to emissions of harmful substances, fires and explosions; thermal pollution
6	Private cars and taxis	pollution of atmospheric air, soils, water due to emissions of harmful substances; noise and weak vibration
7	Stationary sources in the airport building (such as: food establishments, hotel business, bookkeeping, cargo packaging and more)	domestic waste (food, wastepaper, chemicals (detergents), etc.); thermal pollution

1.3. Influence of airports on abiotic components

Abiotic components are components of inanimate nature, they determine the possibility of the existence of all groups of organisms in one or another environment [11].

They are divided into:

- Climatic (light, temperature, humidity);
- Soil and relief;
- Physical (noise, magnetic fields, thermal conductivity and heat capacity, radioactivity, intensity of solar radiation)
- Chemical (composition of the atmosphere, water, soil, etc.) [12].

The airport is a rather large and complex engineering structure, so the influence on the abiotic components is quite significant.

Firstly, the airport complex occupies a large area, so it already affects the edaphic component and the relief. If the design of the terrain was not perfect, then the resulted use of territories and soil may be irrational in general.

Secondly, the airport is the area, where aviation and special transport is used on a constant basis, and this causes pollution of air, underground and surface water, adjacent ground, creates noise, vibration and can cause thermal pollution.

Atmospheric air:

If there are industrial premises at the territory of the airport (such as repair and maintenance shop, warehouse, etc.), vapor of petroleum products, solvents, paint and varnish materials, alkalis, acids, aerosols of aqueous solutions of caustic soda, carbon dioxide and sodium phosphorus, sulfur dioxide, nitrogen oxides, carbon monoxide and dust.

The fuel and lubricants depots pollute the atmospheric air and other components of environment with jet fuel, lubricants and special liquids. The fuel vapors come into the atmosphere in the process of:

- filling of reservoirs, fuel fillers and tanks of aircrafts;
- small breathing of reservoirs;
- ventilation;
- evaporation of fuel spilled due to non-compliance with the rules for refueling,

storage, transport and filling of containers.

The use of special equipment, serving aviation technique and helping in maintenance of airfields and air transport exploitation, also significantly affects atmospheric air pollution. Special transport and private cars/taxis contaminates atmospheric air mainly with carbon monoxide, hydrocarbons, nitrogen oxide (which contributes to the destruction of the ozone layer). Also, pollution occurs when spraying anti-icing products, detergents and other specialty liquids.

All together harmful compounds from air transportation processes cause "acidic" rains and affect both global and local climate.

Soil and water objects:

Activities at airports contribute to pollution of soils and water reservoirs by industrial and household sewage containing various physical, mechanical and chemical impurities.

Globally air pollution from air transport comes back to the surface with precipitations, causing soil and water pollution. The typical trait of this pollution from airports is the presence of heavy metals.

All buildings and structures for air transportation services (air terminal, hotels, dining rooms, board catering services, as well as territories of air courses adjacent to airports) are the source of household and domestic waste water. The waste water of the airports production sites contain benzene, acetone, petroleum products, acids, alkalis, dissolved metal compounds (aluminum, copper, beryllium, chromium, etc.) and other pollutants.

Some metal salts entering the sewage system can cause corrosion of sewer pipes and their final perforation. As a result, waste water can leak into the soil and pollute underground water, and under the absence of pressure in the water supply networks and poor insulation of water pipes it can enter the drinking water. Among the metals that cause corrosion of pipes are aluminum, zinc, chromium, iron, nickel, tin, copper, lead and silver. For example, aluminum compounds, getting into the water with sewage, delay their self-purification process [13].

Climatic components:

Transport and commercial enterprises at airports also contribute to heat pollution. During the operation of the airport, namely the use of aircraft, carbon dioxide, nitrogen

oxides, sulfur oxides, water vapor and particulate matter are emitted into the atmosphere. Exhaust gases (temperatures of 1000 ° - 2000 ° C) create local atmospheric pollution.

Carbon dioxide produced by combustion in aircraft engines mixes well with other atmospheric components. And the nitrogen oxides (which are produced at very high temperatures during combustion of the fuel in the engine) quickly react and lead to changes in the amount of gases available in the atmosphere - ozone and methane. In the troposphere, the amount of water vapor is insignificant compared to the existing concentrations in the atmosphere, but together with solids, water vapor can lead to the formation of condensation traces, which can cause cloud formation. The air transport is said to be responsible for 6-12% of manmade greenhouse effect in the atmosphere.

Simultaneously, airports have similar impact on the local microclimate by reducing amplitudes in the daily temperatures and reducing direct solar radiation due to cirrus clouds formation after contrails dissipation [14].

Electromagnetic fields:

At the airports of civil aviation, the electromagnetic environment is determined mainly by the radiation of powerful radar stations. First and foremost, they include surface survey radar stations operating in the ranges of ultrahigh and high-frequency frequencies. Also the formation of technogenic electromagnetic fields in the airports interacts with mobile base stations. The operating frequencies of UHF radios and mobile base stations are very close and are not separated by standard measuring instruments. Thus, passengers and residents of adjoining territories are exposed to the combined effect of electromagnetic fields from these sources, which leads to the intensified health effects [15].

Security systems and metal detectors in the terminals create strong magnetic fields (up to 100 microtesla). Near the detector frame, the magnetic field strength can approach the threshold level, and sometimes even exceed it [16].

Noise:

Noise is one of the major factors affecting the environment due to activity of air transport. The sources of noise at the aerodrome and the surrounding areas are:

- auxiliary power plants for aircraft and launchers;
- specialized aerodrome maintenance ground equipment, created on the basis of

aircraft engines that used the field resource;

- machine and process equipment, technological processes.

Both approaching and landing aircrafts crate significant noise within the air corridors, all of which are located at low altitudes. Noise is created not only by the engines, but also by the chassis and mechanized wings, as well as the air resistance and auxiliary transport. The noise level at the airport reaches 100 dB, and the premises of dispatchers are subjected to the external noise source of 90-95 dB and terminals experience up to 75 dB noise. This affects both passengers and the staff. The living organisms also react strongly to this type of pollution, and in some cases create additional pollution.

1.4. Influence of airports on biota

Biota is a collection of living organisms (bacteria, mushrooms, plants, animals) inhabiting a certain area of space [17].

As mentioned above, the airport has a great influence on the abiotic components, which in turn affect the biota.

Air pollution directly affects the health of living organisms, but also changes the composition and functional processes in the atmosphere, which in turn affects the physiological processes of plant and animal world.

Unburied particles from solid fuel directly affect the upper respiratory tract, lungs, mucous membranes of the eyes, nasopharynx and oral cavity of animals. Also, harmful substances from the air are deposited on the surface of plants, violating photosynthesis and respiration.

Water flora and fauna, wherever it inhabits (on the surface of the water or at the depths) is exposed to harmful substances that have come either with sewage, or settled out of the air, or in some incidents at airports. Chemical admixtures from industrial effluents can be found in water bodies in relatively small quantities, but even a small increase in their concentration can cause great harm to living organisms.

Pollution with petroleum products, which is characteristic for airports, is particularly harmful for water biota. Higher aquatic vegetation covered with a layer of petroleum

products, resins and other liquid substances of anthropogenic origin (produced by the airport activity) is unsuitable for spawning of fish and the development of fodder organisms.

Pollution of the habitat of waterfowl and other birds and animals leads to a sharp decrease in their number [13].

Soil is the basis for the existence of plants. Given the accumulation of dust, ash and other harmful components on it as a result of the airport's operation, it is possible to follow the change in the composition of the soil, and as a result of the change in the herbage. This is due to the fact that most plants can not adapt to changes in the environment.

Noise pollution quickly causes the disturbance of natural balance in ecosystems. Noise pollution can lead to a violation of orientation in space, communication, food search, etc. In this regard, some animals begin to produce louder sounds, becoming themselves secondary sound pollutants, further violating equilibrium in the ecosystem.

The effect of *electromagnetic waves* on living organisms is complex and insufficiently studied. When interacting with organisms, electromagnetic waves are partially reflected, but partly absorbed and propagated in them. The intensity of influence depends on the amount of energy absorbed by the tissues of the organism, the frequency of waves and the size of the biological object. Under the constant action of low-intensity electromagnetic waves, disorders of the nervous and cardiovascular system, endocrine organs appear [18].

1.5. Risks to the health of people associated with the operation of airports

Noise:

Airports are usually located near the densely populated areas of the city. Therefore, with the growth of cities and the intensification of air transport there is a serious problem of the coexistence of the city and the airport. The population of the airspace and the nearby settlements are experiencing noise from flying planes.

Everyone perceives noise in different ways, depending on the state of health, age, etc. The children and the elderly are most sensitive to noise.

Noise is one of the strongest stimuli at night: it violates the sleeping and resting. The study of the influence of noise on living organisms has showed the development of the

general nonspecific reaction, including the decrease in oxygen consumption by all brain tissues, dystrophic changes in the brain and internal organs, vascular disorders, biochemical changes in the internal organs. Noise strongly affects the auditory analyzer.

With prolonged exposure to intense sounds, the auditory fatigue occurs (this is the reaction of the central nervous system, which manifests itself as a temporary deterioration of hearing). A similar phenomenon is observed, for example, after the exposure to aviation noise.

Long-term hearing loss, that is, deafness occurs due to prolonged exposure to noise (approximately 5-8 years) and insufficient rest for full recovery of hearing.

Constant noise from the airports leads to sleep disturbance, increased fatigue, irritability, mental changes, emotional imbalance, aggression, hypertension, ear noise and hearing loss. Also, noise can increase the heart rate and frequency of breathing, cause changes in blood composition and pressure. High levels of noise, such as 120 dB of jet aircraft noise, can stimulate vestibular irritation and dizziness.

The negative effects of various aviation sources of noise are of primarily concern for operators, engineers and technicians of production units at the airports. The airports staff, air passengers and visitors are less disturbed. The noise levels of the airports are 100 dB, 90-95 dB are in the premises of dispatching services from external sources, and 75 dB are inside the terminal buildings.

Electromagnetic field:

The human body always reacts to the electromagnetic field, which creates the so-called thermal effect (the amount of heat generated in the human body with electromagnetic radiation).

The thermal effect appears due to the fact that the electromagnetic field in the media conducting the electric current (including those of the human body) is responsible for the currents of the ionic conductivity and the polarization orientation of the molecules in accordance with the frequency of the change in the electromagnetic field. This current causes so-called heating of the tissues of the body. In the human body, there are organs with weakly controlled thermoregulation (such as brain, kidneys, eyes, gall bladder) and they have increased sensitivity to electromagnetic radiation.

The biological effect of the electromagnetic field under long-term exposure conditions is accumulated; as a result, long-term effects may develop, including degenerative processes of the central nervous system, brain tumors, blood cancer and hormonal diseases.

The influence of the electromagnetic field is particularly dangerous for children, pregnant (embryo), people with diseases of the central nervous, hormonal, allergy sufferers, cardiovascular systems, people with weakened immune systems.

Persons who have been in the airport area for a long time complain of weakness, irritability, fatigue, weakening of memory, sleep disturbance, a disorder of the menstrual cycle, sexual impotence, headaches, pain in the heart, and so on.

Currently, enough data has been accumulated indicating the negative effect of electromagnetic field on the immunological reactivity of the organism. Adaptation to electromagnetic effects does not occur.

Air pollution:

The air pollution from the work of aircraft and special transport engines causes the formation of smog and the effect of pollutants increases: in case of a compatible action with carbon monoxide, the toxicity of sulfur dioxide increases. Their general effects are manifested in the violation of hydrocarbon and protein metabolism, suppressing the oxidative processes in the liver, brain, spleen and muscles.

Sulfur oxide is also able to react with hemoglobin in blood, causing oxygen starvation, dizziness, breathlessness, and even death. It also causes cardiovascular disorder, and contributes to the development of atherosclerosis.

Nitrogen oxides can cause irritation of the mucous membrane of the eye, which can penetrate the lungs, causing damage to the bronchi. Also, Nitrogen oxides have narcotic effect on the central nervous system and cause degenerative changes in the myocardium.

Most *carbohydrates* have toxic effect, especially when inhaled. At early stages of poisoning the decrease in blood pressure, pulse contraction, and lethargy are observed. In more severe cases, there are clinical seizures, respiratory depression, pupil dilation, and cardiovascular disorders.

The most dangerous pollutant for humans is *benzopyrene*, because it is emitted

directly into the surface layer of the atmosphere, that is, it is at the level of human respiratory system. It has mutagenic and carcinogenic effects.

Not burned particles of solid fuel, soot and aerosols affect the upper respiratory tract, mucous membranes of the eyes, lungs, oral cavity and nasopharynx.

Consequently, getting all these substances in the human body is very dangerous. Moreover, in the course of evolution, the human body has not acquired protective functions from the action of these substances, and secondly, they can be accumulated in human body and gradually destroy it, causing severe diseases of various organs.

Water pollution:

The waters, polluted with airport wastewater, become unsuitable for water supply of the population, because they contain pollutants that adversely affect the health of people and can be the cause of various infectious diseases.

Among the harmful organic compounds characteristic of the wastewater of aviation companies, acetone and benzene should be noted. Acetone has local irritant effect on the skin and mucous membranes. But benzene has an acute local irritant effect, it is absorbed into the skin and causes a general toxic effect on the human body [13].

According to the results of medical research (Pochekaev, E.I., "Population Health and Hygienic Safety of Territories adjacent to the airports"), the population living in the zones of the impact of airports is suffering from the following threats to their health:

- increased general mortality rate (exceeds the average urban indicator);

- more frequent functional deviations in children: cardiovascular disorders, decreased health index (2 - 3,2 times), decreased mental capacity (2,3 times), weakening of non-specific immunity with decreased leukocyte index of intoxication and immunodeficiency states (2.4 - 3.8 times);

- cardiovascular disorders: increased blood pressure;

- increased incidence rates of congenital anomalies – 2.1 times, bone and muscle and genitourinary system – 2.2 times, blood circulation organs, skin and subcutaneous tissue – 1.8 times, digestive system – 1.5 times , respiratory organs – 1.2 times;

- 1.5 times increased incidence of diseases of the blood circulation, respiration, digestion, neoplasms; priority diseases are hypertonic disease and vegetative-vascular

dystonia.

Consequently, as a result of the intensification of the development of civil aviation environmental problems and related health disorders of population are expected to exacerbate [19, 20].

1.6. Conclusions to Chapter 1

The airport is a rather large and complex engineering structure, so the influence on the abiotic components is quite significant. Firstly, the airport complex occupies a large area, so it already affects the edaphic component and the relief. If the design of the terrain was not perfect, then the resulted use of territories and soil may be irrational in general. Secondly, the airport is the area, where aviation and special transport is used on a constant basis, and this causes pollution of air, underground and surface water, adjacent ground, creates noise, vibration and can cause thermal pollution. Accumulated changes of environment quality due to activity of airports affect living organisms inhabiting airport impact area.

The population living in the zones of the impact of airports also suffers from deterioration of health: increased general mortality rate; more frequent functional deviations in children; cardiovascular disorders: increased blood pressure; increased incidence rates of congenital anomalies; increased incidence of diseases of the blood circulation, respiration, digestion, neoplasms.

Obviously, the airport is a dangerous enterprise. Since environmental problems are an important aspect, to solve them, we will analyze airport sites, their environmental policies, existing environmental problems and ways to solve them.

CHAPTER 2
ANALYSIS OF THE ENVIRONMENTAL PERFORMANCE OF AIRPORTS OF UKRAINE

At present, aviation in Ukraine is developing quite rapidly. The main problems of the development of air transport in Ukraine are the outdated fleet of aircraft, the actual lack of domestic transportation, technical and environmental incompatibility of Ukrainian airports with modern international requirements. Therefore, aviation is a source of disturbance of acoustic regime over a large area, the state of atmospheric air and groundwater. Environmental hazards are also posed by oil depots at airports [21].

There are about 20 airports in Ukraine (most of which have international status). As in any country in the world, in Ukraine the airports play strategic role and are an integral part of the economy. Despite all the advantages, an aviation port is a very hazardous object in terms of environmental impact, so such businesses should pay a lot of attention to environmental measures. Based on the legislation of Ukraine, namely the Law on Environmental Protection, the management of enterprises (including airports) is obliged to adhere to the standards, and must take all necessary environmental measures.

The range of negative impacts of air transport operations, in particular flights and maintenance of airplanes, cargo and passengers services, is extremely wide. According to the results of studies on the adverse effects of aviation on the environment, the most important of them are noise during operation of airplanes, emissions of pollutants, electromagnetic radiation, thermal pollution, contaminated waste from the airport.

To address the most important environmental issues of the air transportation a range of initiatives has been implemented at national and international levels. The most discussed environmental issue of aviation is its contribution to global climate change. All the most important international organizations are investing their efforts in the problem solution, primarily it is ICAO. At local levels, airports invest their efforts into the development of environmental plans and their implementation to mitigate the impacts of airports on the environment.

The work on the environmental protection at aviation facilities is formulated and formally declared in the form of an "environmental policy". Environmental policy information can be found on airport websites. Most often, such information includes the following: basic principles of the enterprise environmental policy; objectives of environmental policy; environmental goals achieved. These are key points that may also include environmental review reports, environmental inspection findings.

Also, based on the legislation of Ukraine, namely the Law of Ukraine "On Access to Public Information", the community has the right to receive information, which is given in the reports of Environmental expertise, Environmental Impact Statements, conclusions of the environmental inspection and others [22].

2.1. Official environmental policy and data on websites

2.1.1. Boryspil International Airport [23]

Boryspil International Airport is the main and largest international airport of Ukraine, serving not only Kiev, Kiev region, but also all regions of Ukraine, providing almost two thirds of air passenger traffic in the country. It is the only airport in Ukraine with transcontinental status.

During the study of the airport "Boryspil" the following data were revealed:

- environmental policy;
- notification of planned activities;
- Environmental Impact Statement;
- The strategic plan for the development of the enterprise for 2015-2019 (which describes the strategic goals for reducing the harmful impact on the environment);
- Statement of Intentions and Environmental Impacts on the Construction of KBP Notice of Airport capacity (2020);
- Statement of Intentions to perform design work on the object "Construction of surface water treatment facilities";
- Environmental safety rules (for conducting business activities at the territory of

Boryspil Airport 2019);

- schemes of risk zones by the factor of aviation noise of the Kiev / Boryspil airfield;

- State Enterprise "Boryspil International Airport" management report (which contains information on environmental aspects and energy saving).

The environmental policy of the enterprise describes:

- the strategic environmental goals of the enterprise: integration into the system of leading European transfer airports; continuous development of infrastructure to ensure customer satisfaction; constant increase of the level of corporate culture; constant reduction of harmful in the flow to the environment;

- the ways of their implementation: the most complete satisfaction of consumer requirements, as well as anticipation and implementation of their future needs; compliance with ICAO, IATA and ACI standards and recommended practices, flight safety, aviation safety, legal and airline requirements; raising the professional level of staff through external and internal training; improving working conditions of employees; systematic analysis of the state of aviation safety, flight safety, integrated management system, taking into account the risks and opportunities; compliance with the requirements of environmental legislation, local state environmental organizations and their own instructions; resource management, prevention of negative impact on the environment, control, improvement of environmental indicators and reduction of negative impact on water bodies and atmospheric air;

- the commitment of management: promotion of continuous improvement and development of SE " IA Boryspil" as a profitable and efficient enterprise; providing the enterprise with all the resources necessary for its efficient, safe and uninterrupted operation; ensuring the effective functioning and continuous improvement of the integrated management system based on compliance with the requirements of ISO9001: 2015 and ISO14001: 2015 in full.

2.1.2. Lviv International Airport [24]

Lviv International Airport named by Danylo Halytsky is one of the largest international airports and the largest airport in Western Ukraine in terms of passenger traffic

and route network, opened to replace the old Lviv airport in Levandivka.

During the study of Lviv airport, the following data were found:

- environmental policy;
- The strategic plan for the development of the enterprise for 2019-2023 (which describes the strategic, namely improving energy efficiency through the replacement of equipment, the transition to alternative fuels. insulation, etc.);
- topographic map of the territory;
- public safety zones for the third party risk conditions for the aerodrome of the airport, current loading;
- public safety zones for the third party risk conditions for the aerodrome of the airport, perspective loading;
- map of noise contours (max. daily level);
- map of noise contours (max. night level);
- comprehensive environmental program for 2017-2022 for the city of Lviv (information about the airport in the sections "acoustic background" and "geological environment");
- The Lviv Airport management report for 2018, section "Environmental aspects".

The latter document describes the most important environmental issues set by the management of the airport, including rational use of water, greenhouse gas emissions, waste management, energy consumption, noise and vibration. All the necessary permissions from relevant authorities, concerning these issues have been received by the airport and they are currently valid.

The environmental policy of the enterprise describes:

- the purpose of the enterprise (provision of air transport services with maximum environmental safety and minimal impact on the environment);
- environmental policy of the enterprise (which is aimed at ensuring the efficient use and reproduction of natural resources, environmental protection and environmental safety);
- information on the establishment of the working group on environment protection;
- measures to reduce environmental impacts (improvement of the monitoring and protection system against noise; strengthening control over the operation of radar systems;

strengthening control over waste management from generation to disposal, introduction of separate collection systems for packaging and packaging waste; maintenance of all systems, periodic technical inspection of mechanisms and equipment, periodic training of personnel to avoid the possibility of accidents, cooperation with state and public authorities. organizations and stakeholders; strengthening control over the work of personnel who use sources of ionizing radiation in their activities).

2.1.3. Dnipropetrovsk International Airport [25]

Dnipropetrovsk International Airport is one of the longest airports in Ukraine, located in the southeast of Dnipro. The city is connected through the direct flights with Kyiv, Vienna, Ivano-Frankivsk, Tel Aviv. It is able of servicing 3,000 air passengers daily.

During the study of the airport " Dnipropetrovsk " the following data were found:

- information on the environmental values of the enterprise ("We protect and actively contribute to the improvement of nature, minimizing the negative impact on the environment, implementing energy-saving and environmentally friendly technologies in production, taking care of the surrounding areas.");

- basic principles of environmental policy of the enterprise:

- ensuring optimal quality of the environment;
- continuous improvement of the system of ecological control in production and in structural subdivisions;
- increased level of responsibility for environmental pollution;

- environmental policy objectives:

- development and systematic improvement of the environmental management system;
- minimize the use of hazardous substances and products, replacement with harmless substances;
- carrying out systematic monitoring of environmental aspects and assessment of their impact on the environment;

• introduction of modern technologies and modernization of existing production processes, in order to reduce the specific emission of harmful substances into the atmosphere, to water bodies, waste generation;

• stimulating the reduction of noise caused by aircraft operation;

- the list of implemented environmental measures: landscaping of adjacent areas; use of eco-friendly technologies; materials and raw materials; control of the environment; the desire to minimize the impact of aircraft emissions; the use of scaring system harmless to birds; rational consumption of natural resources;

- report on the Strategic environmental assessment of the Dnipropetrovsk International Airport;

- zones of restriction of housing construction due to the factor of aviation noise.

2.1.4. Zaporizhzhia International Airport [26]

Zaporizhia International Airport is one of the most important enterprises of transport infrastructure for the eastern and south-eastern regions of Ukraine.

During the study of the airport "Zaporozhia" the following data were found:

- The strategic environmental assessment report of the Zaporizhia City Development Strategy until 2028 (there is information on the development of the airport, but it is not known whether it includes environmental protection); the corresponding charter on the international airport "Zaporozhye" states that "complies with the norms and requirements for environmental protection, rational use and reproduction of natural resources and environmental safety";

- the Statement on environmental consequences of the project "Reconstruction and technical re-equipment of radio navigation equipment and landing facilities of the airport";

- environmental impact assessment of the project "Construction of a new terminal and office buildings Zaporizhia International Airport";

- information on the development of the map of the restricted area under the influence of aviation noise for the aerodrome of "Zaporizhzhya International Airport".

2.1.5. Mykolayiv International Airport [27]

Mykolayiv International Airport is one of the international airports of Ukraine, which is located in Mykolayiv region.

During research of the Mykolayiv airport the following data were revealed:

- the Environmental Impact Statement of the airport;
- the Environmental Impact Statement of the treatment plant construction project;
- the Statement of Intentions for the construction of treatment facilities, which states that all impacts on the environment are either neglectable or within the acceptable limits;
- scheme of the aerodrome territory;
- protected areas from laser radiation;
- areas of restriction of buildings in terms of aviation noise;
- map of the sanitary protection zone based on the level of air pollution.

2.1.6. Ivano-Frankivsk International Airport [28]

Ivano-Frankivsk International Airport is located near the center of Ivano-Frankivsk, has international status since 1992. Maximum passenger traffic - 150 passengers per arrival and 150 passengers per departure per hour. The airport has one passenger terminal.

During research of the Ivano-Frankivsk airport the following data were revealed:

- protection zones around Ivano-Frankivsk airport regarding the ban on the use of laser devices.

There is no information on environmental policy and environmental activities.

2.1.7. Kyiv International Airport [29]

Kyiv International Airport named by Igor Sikorsky (Kyiv-Zhulyany Airport) is the second largest international passenger airport in Ukraine. The territory covers an area of 265 hectares.

During the study of Kyiv airport, the following data were found:

- The airport "Kyiv" management report, which describes the environmental aspects, but only in the form of the list of available permissions from nature protecting authorities (the presence of a permit for emissions of pollutants from 6 organized sources of emissions, 1 unorganized and 1 mobile);

- characteristics of the airport;

- zones of maximum noise levels (night and daily);

- risk contours of public security zones;

- decision on approval of the Strategic Concept for further operation and development of the Kyiv International Airport (Zhulyany): “further restrictions may be the result of limited time of infrastructure use (for example, night flight restrictions, etc.), restrictions on the number (for example, permitted number of take-offs, etc.) or restrictions on the technologies used (eg noise restrictions, etc.) ";

- Environmental Impact Assessment Report of the planned activity "Extraction of drinking groundwater from the well".

There is no information on environmental policy.

2.1.8. Kryvyi Rih International Airport [30]

Kryvyi Rih International Airport (Lozuvatka International Airport) is a civilian airport in Kryvyi Rih. The total land area of the airport is 166.1187 hectares.

No data were found during the investigation of Kryvyi Rih airport. There is only information on the level of risk in the field of environmental protection - defined as "high risk" and the date of scheduled inspection - 03.12.2018 (information found on the site of the inspection portal).

2.1.9. Odessa International Airport [31]

Odessa International Airport is one of the largest international airports in Ukraine, located southwest of the city center. It has airline connections with many cities in Ukraine, Eastern Europe, as well as Western Europe, Asia and Africa.

During the study of the airport "Odessa" the following data were found:

- housing restriction areas based on aviation noise influence;
- statute of the municipal enterprise "Odessa International Airport" (which states the obligation to comply with the requirements for environmental protection, rational use and reproduction of natural resources and environmental safety);
- zones protected from the influence of laser radiation;
- building restriction area under electromagnetic radiation factors of impact;
- public security zones from the third party risk;
- Environmental Impact Assessment conclusions (03/28/2019);
- Environmental Policy of the enterprise;

The environmental policy of the enterprise describes:

- information on participation in social actions "Let's make Ukraine clean", "Plant a tree", "Stop ragweed";
- introduction of energy-saving and environmentally friendly technologies in production;
- introduction of separate collection of municipal waste;
- gradual replacement of fluorescent lamps with LEDs, old diesel generators with new ones;
- raising the level of awareness of employees in the field of environmental protection, motivating them to the rational use of natural resources, educating the culture of waste management;
- obtaining permits in the field of waste management and emissions of pollutants into the atmosphere;
- implementation of production control over compliance with the requirements of structural units of the enterprise and third-party organizations located at the airport, current legislation, instructions, rules and regulations on environmental protection;
- keeping primary records of waste generation and packaging at the enterprise on the form №1 - WT;
- payment of environmental tax for emissions of pollutants into the atmosphere;
- payment of environmental tax for emissions of pollutants into the atmosphere;

- development and production of maps of the aerodrome area with the boundaries of restricted areas around the aerodrome in terms of exposure to aviation noise, electromagnetic radiation, third party risk, boundaries of sanitary protection zones in terms of air pollution and obtaining a positive opinion of the Institute of Public Health. O.M.Marzeeva NAMS of Ukraine regarding land use within these zones;
- participation in work on drawing up of technical tasks and designing of new, expansion and reconstruction of operating manufactures taking into account requirements of environmental protection, consideration of the technical documentation which is developed;
- monitoring the condition of green areas, organization of work on the formation of tree crowns, sanitary pruning of trees, prevention of nesting birds, obtaining technical conditions for sanitary pruning of green areas in "Miskzelentrest";
- ensuring work with permitting and controlling bodies;
- monitoring of the legislation of Ukraine on environmental protection, making proposals to new bills.

2.1.10. Sumy Airport Municipal Utility Company [32]

Sumy Regional Utility Company is a state airport, located in Sumy. It has been able to accept international flights since December 8, 2006.

There is no information on environmental policy and environmental activities. The site is missing. Currently, Sumy Airport is almost inactive, except for charter flights. (Found in Report on the natural environments state in the Sumy region in 2016 year).

2.1.11. Rivne International Airport [33]

Rivne International Airport is a passenger airport located in the south-western direction from the city of Rivne. The total area of the land plot assigned to the enterprise is 165.0435 hectares.

During the study of the airport "Rivne" the following data were found:

- building restriction zones due to aviation noise;

- the reports on the consumption of natural resources;

- the Strategic Environmental Assessment report of the development strategy of Rivne region for the period until 2027 (information on the development of the airport, which does not contradict the national environmental goals).

Environmental policy, goals and measures to protect and preserve the environment on the open resources of the airport were not found.

The program of development and support of the regional utility company "Rivne International Airport" for 2018-2020 contains the following "environmental" goals:

- improvement of the water supply and sewage collection;

- replacement of street lighting in the central alley with LEDs;

- replacement of windows in the administrative building with energy-saving ones.

2.1.12. Uzhhorod International Airport [34]

Uzhhorod International Airport is an international airport that serves the city of Uzhhorod in Transcarpathia. It is unique as the take-off and landing are done through the airspace of Slovakia. The airport is located on the western outskirts of Uzhgorod.

During the research of Uzhhorod airport the following data were revealed:

- the Strategic Environmental Assessment report of the development strategy of Zakarpattia region for the period 2021 - 2027 (draft for public discussion) - there is information on the possible impact on air, climate and transboundary impacts;

- the Strategic Environmental Assessment report of the urban planning documentation "Amendments to the master plan of Uzhgorod";

- the Strategic Environmental Assessment report of the territory within the limits of Polina Osypenko, Gvardiyska, Enkovska streets and the territory of the airport (available information on the impact of the environment and the state of Uzhhorod airport);

- restrictions and protection zones of Uzhhorod airport;

Website, environmental policy, goals and measures for environmental protection and preservation were not found. All information about the condition and impact of the airport

was found on the website of the Uzhhorod City Council and other resources.

2.1.13. Kharkiv International Airport [35]

Kharkiv International Airport is located south to the city center, the largest in Eastern Ukraine. The number of passengers served in 2019 was 1,340,000.

During the research of Kharkiv airport the following data were revealed:

- report on the activities of "NEW SYSTEMS AM" (Kharkiv Airport), as an air navigation service provider, for 2017 (which contains information that in January 2017 and November 2018 the staff of the department was tested for knowledge of environmental safety);
- airport scheme;
- contours of the maximum noise levels of "Kharkiv";
- the notification about environmental control post opened and operating in the Kharkiv-Airport).

Environmental policy, goals and measures for environmental protection and preservation were not found.

2.1.14. Ternopil International Airport [36]

Ternopil International Airport is located 7.5 km southeast of the center of Ternopil. Area - 154 hectares.

During the research of Kharkiv airport the following data were revealed:

- the company's charter (in the section "Rights and Responsibilities") contains information on compliance with environmental legislation;
- noise contour map;
- building restriction zone due to flight safety conditions.

Environmental policy, goals and measures for environmental protection and preservation were not found.

2.1.15. Chernivtsi International Airport [37]

Leonid Kadenyuk Chernivtsi International Airport is an airport in the southwestern part of Ukraine. The number of serviced passengers in 2019 was 76,828.

During the study of the airport "Chernivtsi" the following data were found:

- flight zones protected from the effects of laser radiation in the area of Chernivtsi airfield;
- information on aviation noise measurement and zoning of the territory around the Chernivtsi International Airport under the influence of adverse factors and third party risk (public contract);
- regional report on the state of the environment in Chernivtsi region (information on the monitoring point for radioactive contamination of the atmosphere in Chernivtsi international airport).

Environmental policy, goals and measures for environmental protection and preservation were not found.

2.1.16. Poltava International Airport [38]

Poltava International Airport is an airport located 7 km west of Poltava. The airport has a passenger terminal with a total area of about 5 thousand m^2 and a design capacity of 400 passengers per hour.

The survey of Poltava Airport did not reveal any data on environmental policy, environmental goals and measures, noise zones and no reports or public information on environmental activities.

2.1.17. Kherson International Airport [39]

Kherson International Airport is an airport in the village of Chornobaivka near Kherson. Passenger traffic in 2019 - 154,000.

During the study of the airport "Kherson" the following data were found:

- aerodrome territory (map) with protection zones;

- map of laser-protected areas.

There is no environmental policy, information on goals and measures aimed at environmental protection, reports on the state of the environment, information on environmental conclusions and examinations.

2.1.18. Vinnytsia International Airport [40]

Vinnytsia Airport (Gavryshivka) is a Ukrainian international airport located 10 km from the center of Vinnytsia. Passenger traffic in 2019 was 40 124.

During the study of the airport "Vinnytsia" the following data were found:

- noise map;

- restrictions on the laser;

- the Strategic Environmental Assessment report of the Strategy of Balanced Regional Development of Vinnytsia Region for the period up to 2027, which contains information on the future reconstruction / modernization of Vinnytsia Airport and its possible impacts on the environment;

- report on the state of the environment in Vinnytsia region in 2016 (information on the maximum levels of radiation in 2014-2016 at the airport).

There is no environmental policy, information on goals and measures aimed at environmental protection, reports on the current state of the environment, information on environmental conclusions and expertise.

2.1.19. Cherkasy International Airport [41]

Cherkasy International Airport is located in the western part of the city. The airport has international status, but it is used mainly for domestic flights. It has a single runway, which by all characteristics is the third in Ukraine in terms of capacity after both Kyiv. During the research of Cherkasy airport no environment protection related documents were not found.

2.1.20. Zhytomyr International Airport [42]

Zhytomyr Serhiy Korolyov International Airport (Zhytomyr-Smokivka Airport) cannot serve passenger traffic. Thus, it has no documents related to environment protection in open resources.

2.2. Data in the media about airport`s work

Table 2.2

Data in the media about airport`s work

№	Name of the airport	Data in the media about airport`s work
1	2	3
1	Boryspil International Airport	Internet-publication “KievVlast”: “Boryspil International Airport” is in the list of the largest waste generators in the Kiev region.
2	"Lviv International Airport" them. Danylo Halytskyi	- "Zaxid.net": "On August 8, 2007, they checked the Lviv International Airport (fuels and lubricants)," no gross violations were detected"; - "Galinfo.com.ua": In June 2013, during the forum "Development of airports in Russia and the CIS", IA "Lviv" Danylo Halytsky was awarded the title of "Best CIS Airport";
3	Dnipropetrovsk International Airport	- Tripway.com: "The administration of Dnipropetrovsk airport is committed to minimizing the negative impact on the environment. Energy-saving technologies and environmentally friendly materials are constantly used in production." - Internet-publication "Day": "The leadership of the Dnipropetrovsk region has identified priorities for 2020 - the construction of the airport, attracting investment, environmental programs that will reduce harmful emissions into the air."
4	Zaporizhzhia International Airport	UVT GROUP: "Successful passing of environmental examination of the project of the international terminal of the Zaporozhye airport."
5	Mykolayiv International Airport	2020 AAUCA: "September 12, 2019 at the Mykolayiv International Airport a meeting of the Committee on environmental Security of the Association "Airports of Ukraine" took place."
6	Ivano-Frankivsk International Airport	-
7	Kyiv International Airport	- Gov.ua: "Petition №8222 Prohibit takeoffs and landings of planes at night and aircraft that create noise in excess of noise standards at Kyiv airport." - OBOZREVATEL: "Now" Zhulyany is a source of critical noise pollution, in addition, aircraft engines during takeoff and landing significantly pollute the air and emit a lot of hazardous compounds, from nitrogen and sulfur oxides to soot and toxic hydrocarbons. It is also a source of groundwater pollution due to the leakage of fuel and oils that enter the underground horizons, destroying aquifers. "

table 2.2 continuation

1	2	3
8	Kryvyi Rih International Airport	-
9	Odessa International Airport	-
10	Sumy Airport Municipal Utility Company	-
11	Rivne International Airport	-
12	Uzhhorod International Airport	Menr.gov.ua: The airport is included in the list of objects that pose a high environmental risk.
13	Kharkiv Intern. Airport	-
14	Ternopil Intern. Airport	-
15	Chernivtsi International Airport	-
16	Poltava International Airport	-
17	Kherson International Airport	-
18	Vinnytsia International Airport	UVT GROUP: "Reconstruction of the terminal of Vinnytsia International Airport."
19	Cherkasy International Airport	-
20	Zhytomyr International Airport	- 20minut.ua: "600 thousand tons of poisonous soil were taken to the Malynsky market area, the airport (for the construction of the strip) and the children's hospital in Stanyshivka." - Zhitomir.INFO/ State Ecological Inspectorate: "Environmentalists have estimated more than UAH 2 million in losses due to oil-contaminated soil near the Zhytomyr airport."

2.3. The environmental infractions of Ukrainian airports

The following sources were analyzed to identify environmental infractions at Ukrainian airports: Inspection data (for the last 3 years), found on the website of the Inspection Channel; Environmental assessment reports; Management reports; Publications on the study of these airports; Reports on the state of the environment of airports and the regions in which they are located. Environmental infractions are given in Table 2.3.

Table 2.3

Environmental infractions

№	Name of the airport	Risk criterion (from last audit)
1	**Boryspil International Airport**	High
Environmental aspects	- very high energy consumption (because a large airport has a huge passenger flow); - high noise pollution; - formation and discharge of industrial and domestic wastewaters; - discharge of contaminated return water; - surface runoff; - emissions of pollutants from stationary and mobile emission sources (CO, CO2, NOx; hydrocarbon; kerosene combustion products); - waste generation (used absorbent); - formation of solid household waste; - formation of waste sand contaminated with fuels and lubricants; - risk of accidents due to outdated equipment; - leakage and spillage of fuels and lubricants materials, special liquids and chemical reagents.	
2	**"Lviv International Airport" them. Danylo Halytskyi**	High*
Environmental aspects	- irrational water use; - increased temperature in the surface layers of the atmosphere due to the CO_2 emissions, - discharge of rainwater into an existing water body; - noise pollution; - electromagnetic pollution from the operation of base stations and landing systems; - air pollution by combustion products of fuel, negative impact on the ozone layer; - pollution of air, water resources and soils due to the use of chemical reagents for the treatment of the runway and radioactive materials; - the possibility of pollution by waste of ancillary production; - the possibility of accidents due to malfunction of systems, mechanisms and equipment.	

table 2.3 continuation

3	**Dnipropetrovsk International Airport**	-
Env. aspects	- water use; - emissions of chemicals into the atmosphere; - waste generation; - discharges of chemicals into the sewer; - risk of accidents due to outdated equipment; - noise pollution.	
4	**Zaporizhzhia International Airport**	High
Env. aspects	- exceedance of permitted volumes of discharges; - control over water quality of water bodies in control areas is not provided; - incorrect inventory of waste generation sources. - no measures have been taken for efficient management of waste; - no special passports for waste generated; - no register maps of waste generation, treatment and utilization facilities.	
5	**Mykolayiv International Airport**	High
EA	- noise and vibration pollution; - water use; - evaporation of reagents; - emissions from aircraft stationary sources and special vehicles; - risks of accidents due to old equipment.	
6	**Ivano-Frankivsk International Airport**	-
Env. aspects	- noise and vibration pollution; - water use; - waste generation; - evaporation of reagents; - emissions from aircraft stationary sources and special vehicles; - risks of accidents due to old equipment.	
7	**Kyiv International Airport**	High
Env. aspects	- exposure to chemicals; - high noise pollution (by 8-15 dBA); - spills of lubricants into the soil; - water use and rainwater discharge (with excessive content of heavy metals and petroleum); - emissions of pollutants from stationary and mobile emission sources; - waste generation; - electromagnetic pollution; - the risk of accidents because the equipment is outdated; - located near the city.	

table 2.3 continuation

8	**Odessa International Airport**	Medium
EA	- emissions of pollutants from stationary sources and special vehicles; - electromagnetic pollution; - waste generation is not controlled.	
9	**Sumy Airport**	High*
EA	- risk of accidents due to outdated equipment (almost not working)	
10	**Rivne International Airport**	High*
EA	- risk of accidents due to outdated equipment; - leakage and spillage of special liquids; - formation of municipal solid waste; - noise pollution; - no information on air, water and soil pollution.	
11	**Kryvyi Rih International Airport**	Medium
Environmental aspects	- Contracts for waste disposal or utilization are not signed; - Monitoring studies of waste generation, storage and disposal sites are not carried out; - Inventory of waste, waste passports and waste generation facility cards are absent; - Control over the condition and impact of deepened tanks on soils and underground aquifers is not carried out; - Technological standards of water use per unit of output are absent; - The calculation of the environmental tax for the disposal of waste in specially designated areas is not carried out; - Control over the impact of silt sites on the condition of surface and groundwater, soils and atmospheric air is not conducted; - The sanitary projection zone of water intake is absent; - Permission for special water use from the underground source (well) during the period from 12/02/2015 to 06/07/2016; - Control over the volume and composition of pollutants emitted into the air, the calculation of the tax liability from the environmental tax charged for emissions into the air is not carried out; - Inventory of sources of emissions of pollutants into the atmosphere at the enterprise is not carried out. There is no permit for emissions of pollutants into the atmosphere from the above sources.	
12	**Uzhhorod International Airport**	High
EA	- there is no permit for emissions of pollutants from stationary emission sources; - risk of accidents due to outdated equipment and located within the city; - formation of municipal solid waste; - noise pollution; - general information on air, water and soil pollution.	

table 2.3 continuation

13	**Kharkiv International Airport**	Insignificant
EA	- noise pollution; - getting detergents and lubricants; - emissions from aircraft, stationary sources and special vehicles; - risk of accidents due to old equipment.	
14	**Ternopil International Airport**	High*
EA	- noise pollution; - spills of detergents and lubricants; - emissions from stationary emission sources and special vehicles; - risk of accidents due to old equipment.	
15	**Chernivtsi International Airport**	Insignificant
EA	- evaporation of chemicals, spillage; - emissions from boiler houses, special vehicles; - noise pollution, which is an important issue as the airport is located near the city; - general information on air, water and soil pollution; - risk of accidents due to old equipment.	
16	**Poltava International Airport**	High*
EA	- no information; - risk of accidents due to old equipment.	
17	**Kherson International Airport**	-
EA	- no information; - risk of accidents due to old equipment.	
18	**Vinnytsia International Airport**	High
EA	- formation of municipal solid waste; - leakage and spillage of special liquids; - information on air, water and soil pollution is missing or too general; - risk of accidents due to old equipment.	
19	**Cherkasy International Airport**	High*
EA	- formation of solid household waste; - leakage and spillage of special liquids; - information on air, water and soil pollution is missing or too general; - health risks for the settlement; - risk of accidents due to old equipment.	
20	**Zhytomyr International Airport**	Medium
EA	- the responsibilities of economic entities in the field of waste management are not fulfilled, no passports, is not recorded in the journal of the established sample (waste), no responsible persons in the field of waste management is appointed; - noise pollution; - risk of accidents due to old equipment.	

Table legend:

High = significant impact on the environment according to recent inspections;

High* = significant impact on the environment according to MES.

Medium = medium impact on the environment according to recent inspections;

Insignificant = insignificant impact on the environment according to recent inspections;

«-» = no information available [43].

2.4. Conclusions to Chapter 2

During the study, web-sites of Ukrainian and international airports were analyzed, as well as open-access and information on the sites of regions of Ukraine regarding the environmental impact of airports, reports and development plans. The analysis shows that environmental policy is available and accessible for only major airports of Ukraine, while most of others didn't declare any commitments to environment protection. Moreover, the analysis of environmental inspection reports shows the continuous violation of nature protecting regulation in the activity of many airports. Thus, there is a need for improvement of nature protecting activity improvement through the well-organized documentation of environmental aspects, planning of actions and accounting local aspects of their activity by interacting with local population.

CHAPTER 3
EVALUATION AND IMPROVEMENT OF THE ENVIRONMENTAL POLICY OF UKRAINIAN AIRPORTS

3.1. Environmental rating of Ukrainian airports

Having analyzed the environmental performance of Ukrainian airports we are now able to rate them by aggregating their environmental efficiency in points of the special scale. The grading principles are the following:

- Parameter 1 – planning and documentation of environment protection activities – 1 point for each of the necessary environmental document available in open access;

- Parameter 2 – violations of the nature protection legislation according to the official information from the Environmental inspection - minus 1 point for each infraction;

- Parameter 3 – presentation of environmental activity in mass media – plus 1 point per each organized positive event and minus 1 point per each negative event mentioned in mass media.

The total results of the evaluation are given in Table 3.1. Thus, we can see the degree of environmental efficiency. As a result, we have:

➢ Airports with positive environmental performance.

Top 4: 1- Boryspil International Airport;

2- Lviv International Airport;

3- Dnipropetrovsk International Airport / Mykolayiv International Airport;

4- Odessa International Airport;

➢ Eight (8) airports with zero efficiency (cannot be estimated due to lack of any environmental information);

➢ Airports with negative efficiency (the number of violations detected by the inspection had a very strong impact on the result).

Top 3: 1- Zaporizhzhia International Airport;

2- Kryvyi Rih International Airport;

3- Zhytomyr International Airport.

Table 3.1

The total results of the evaluation

№	Name of airport	Availability of documents	Violations	Media information		Total
1	Boryspil International Airport	8	0	1	-	7
2	Lviv International Airport	4	0	2	+	6
3	Dnipropetrovsk Internat. Airport	3	0	2	+	5
4	Zaporizhzhia Internat. Airport	2	-19	2	+	-15
5	Mykolayiv International Airport	3	0	2	+	5
6	Ivano-Frankivsk Intern. Airport	0	0	0	0	0
7	Kyiv International Airport	3	0	1	-	2
8	Kryvyi Rih International Airport	0	-13	0	0	-13
9	Odessa International Airport	3	0	0	0	3
10	Sumy Airport	0	0	0	0	0
11	Rivne International Airport	2	0	0	0	2
12	Uzhhorod International Airport	1	-1	1	-	-1
13	Kharkiv International Airport	0	0	0	0	0
14	Ternopil International Airport	0	0	0	0	0
15	Chernivtsi International Airport	0	0	0	0	0
16	Poltava International Airport	0	0	0	0	0
17	Kherson International Airport	0	0	0	0	0
18	Vinnytsia International Airport	0	-2	1	+	-1
19	Cherkasy International Airport	0	0	0	0	0
20	Zhytomyr International Airport	0	-4	1	-	-5

Aggregating the obtained results we can conclude that the major issues to be addressed by the environmental policy of any airport are:

✓ Electromagnetic pollution;

✓ Vibration and noise pollution;

✓ Discharge of industrial and municipal wastewater;

✓ Air pollution (emissions of pollutants from stationary and mobile emission sources);

✓ Increase in temperature in the surface layers of the atmosphere due to greenhouse emissions, in particular CO2 and hydrocarbons;

✓ Soil pollution with petroleum products, heavy metals, cleaning agents and other aggressive substances;

✓ Landscape change;

✓ Leakage and spillage of special liquids, used for aircraft surface treatment;

✓ Waste generation;

✓ Risk of accidents due to outdated equipment;

✓ Non-compliance with environmental legislation.

3.2. Recommendations for the improvement of environmental policy in Ukrainian airports

Airport environmental policy is a system of measures related to the management of airport environmental performance. The aim of environmental policy is to develop and implement the strategy for mitigation of impacts on nature. Thus, the airport must take specified environmental responsibilities for minimizing its impact on the environment.

Any environmental policy should include *strategic goals* and *tools / methods to achieve* these goals. Before planning or improving environmental policy, an airport should conduct the environmental audit and define the areas that need to be managed.

Environmental policy development can be divided into two stages:

- technical and documentary;
- social (marketing and work with the population / consumers).

3.2.1. Recommended environmental documents to be developed and implemented

It is impossible to build and communicate to society a good, transparent and stable environmental policy without "arguments" - the technical and documentary part. The necessary components of the environmental policy of large and small airports are similar, but there are some differences in the scale of implementation, funding, status of the company, location (megalopolis or small town), the capabilities of the company and so on. (Table 3.2).

Table 3.2

The recommended extent of environmental policy components development for Ukrainian airports

№	Elements of environmental policy	Large	Small
1		2	3
1	Site = section "environmental policy"	well developed, with clear formulation of goals and approaches and methods of achievement	well developed, with clear formulation of goals and approaches and methods of achievement
2	Documentation / reporting	relevant documentation (notification of planned activities, statement of environmental impact, conclusions of ecological expertise, strategic plan of enterprise development,) must be present and made available to the public	relevant documentation should be present and made available to the public (*but* some basic documents may be absent due to the level of impacts on the environment)
3	Measures for environmental protection	required (*permanent* organization of measures, participation in local and international environmental programs, etc.)	desirable (*sometimes:* organization of events, participation in local environmental programs, etc.)

table 3.2 continuation

1	2	3	4
4	Maps	sanitary protection zone; building restriction zone, aviation noise impact zone (day / night)	sanitary protection zone; building restriction zone, aviation noise impact zone (day / night) – if there is the case, depending on the scale of operations
5	Certificates	must be present and made available to the public	must be present and made available to the public
6	Monitoring and its results	mandatory monitoring and results / statistics for each environmental aspect	mandatory monitoring and results, *but* some components could be missing
7	Information on treatment facilities/waste management/ undertaken measures	*mandatory information* on the implemented measures to reduce the impact on the environment, on the availability and functionality of treatment facilities and waste management	*mandatory information* on the implemented measures to reduce the impact on the environment (*desirable* information on the availability and functionality of treatment facilities and waste management)
8	Environmental education of employees	there must be *continuous* environmental education of staff, the airport must ensure that all employees are aware of the policy and have an understanding of its contents	there should be *periodic* environmental training of staff, the airport should ensure that all employees know about the policy and understand its content
9	The satisfaction of legal and regulatory compliance obligations	mandatory	mandatory
10	Commitment to continuous environmental improvements	mandatory	mandatory
11	Additional information	preferably before execution	preferably to be performed, but not required to be performed

Nowadays, environmental policy is not only a reflection of the attitude to the environment, but also a powerful advertising campaign. Thus, if the company wants to gain a certain reputation and status, it is impossible without minimizing the impact on the environment.

3.2.2. The Regional environmental Aspects of airports to be accounted in the policy

The airport is considered a dangerous object, so its location must be well thought out. Not every plot of land may be suitable for such an enterprise. The following factors must be taken into account when deciding on the construction site of the airport: seismicity, distance to the nearest settlements, the presence of areas of the reserve fund, location of water horizons, soil type, possible noise exposure, etc.

In some cases, the airport is still located in sensitive areas, demanding specific solutions to address possible local issues. Looking at the location of airports, the following airports in Ukraine are located near residential buildings: Ivano-Frankivsk International Airport, Kyiv International Airport. Sikorsky (Zhulyany), Lviv Airport, Zaporizhia International Airport, Uzhhorod International Airport, Kharkiv International Airport, Ternopil International Airport, Leonid Kadenyuk Chernivtsi International Airport.

Given the specific (more dangerous) location of airports, we can offer a number of specific actions to reduce the impact on people and the environment:

✓ enhanced control over dangerous objects on the territory of the airport;

✓ more frequent monitoring of atmospheric air;

✓ additional wastewater treatment if wastewaters are discharged in locally important water resources;

✓ enhanced control of the receipt / spraying of chemicals, petroleum and lubricants from aircraft maintenance and the use of substances with reduced environmental impact;

✓ development of green spaces;

✓ protection against electromagnetic pollution not only within the airport, but at the areas out of the airport:

- shielding (active and passive; complex shielding);

- constructive improvement of equipment in order to reduce the used levels of EMF, the total consumed and radiated power of the equipment;

- monitoring of EMF levels;

✓ enhanced control and reduction of noise and vibration pollution:

- planting trees;

- reducing noise at the source of its formation through the use of new technologies;
- possibly increasing the height of waiting and maneuvering;
- restriction of night and training flights;
- use of special vehicles to move the aircraft to / from the runway;
- landing by the method of constant reduction (but this needs a very good training);
- use of sound-absorbing structures (walls, ceilings, observation cabins, casings, facings, mufflers, noise shields - are an obstacle between the noise source and the protected area, which do not allow rectilinear sound propagation (for noise shields are used gabion masonry, transparent plastic, sound-absorbing plastics, aluminum and ferrous metals, absorb materials - porous aggregates (vermiculite, perlite), mineral fiberglass, geotextiles).

In the cases, the airport is still located in the vicinity of protected areas, an important issue is biological safety: prevention of aircrafts collision with birds and overall expansion of biota to the territory of airport, minimization of disturbance of fauna in critical period; reduction of noise, air and water pollution. The adjoining agricultural fields will be also sensitive to potential pollution of ground waters and soils [44, 45].

3.2.3. Recommendations for airports on the public participation organization in the field of environment protection

An important element in detecting environmental problems is communication with the local population and consumers. This must be done in two locations: on the territory of the airport itself and beyond.

In order to identify the environmental concerns of consumers and local people, a series of actions should be taken:

1) A consumer survey, which will include both answers to questions about problems and suggestions that consumers would like to implement.

Approximate examples of survey questions:

- Do you feel discomfort due to noise in the airport buildings? (evaluation of noise attenuation and quality of existing measures);
- Do you feel heavy breathing? (evaluation of the adequacy of measures already taken to

reduce air pollution - there are people who are very sensitive to air pollution);
- Does your state of health change after staying at the territory of the airport?;
- Are there any odors? (evaluation of problems with sewage, fuel conservation, spraying chemicals, etc.);
- How would you evaluate the sanitary and hygienic situation in the airport and in its territory? (evaluation of the waste management quality, etc.);
- What changes would you like to see in the airport from an environmental point of view? (determining the desires of visitors - for example, more plants).

2) Surveys of the local population, which will include both answers to questions about problems and proposals that consumers would like to implement.

Approximate examples of survey questions:

- Has your health changed since the beginning of the airport activity / from the beginning of your living here?;
- Does the noise bother you? What time does the noise bring discomfort? (time / day / night)
- Has the frequency of diseases changed?;
- Are there any odors or difficulty breathing?;
- Do you feel the vibration? (if the airport is very close to residential buildings);
- What changes would you like to see in the environmental performance of an airport?.

* Thanks to such surveys, management can also control the quality of work of employees in the field of ecology.

* Surveys should be carried out regularly: for visitors once every several months, and for the local population - once every six months. (These are approximate recommendations. The exact periodicity can be established after research)

3) Creation of hot lines or a reception center for local residents / visitors regarding complaints and suggestions in the environmental sphere (it could be integrated with the customer support center, but notify about this).

3.3. Conclusions to Chapter 3

The comparative analysis of environmental policy of and performance of Ukrainian airports was conducted using specially defined parameters. The results of the evaluation showed that only 7 airports demonstrate positive efficiency, while 5 have negative performance. The biggest number of airports has zero efficiency, which is also a negative trend, as the absence of positive actions is also the reason for environment degradation. To improve the existing situation we have developed recommendations on the list and content of environmental documents to be developed and implemented at airports and possible regional environmental aspects of airports to be accounted in their policy. Additionally we believe that there is a need to involve public to organization and optimization of nature protecting activity in airports. For this purpose the recommendations for airports on the public participation organization in the field of environment protection were developed.

CONCLUSIONS

1. An airport is a complex of engineering structures designed for the dispatch, acceptance and technical maintenance of air transport, as well as passenger and cargo services. Thanks to the aviation industry, there are about 65 million jobs worldwide: approximately 10 million direct jobs and 11 million indirect jobs.

2. The main sources of environmental impact on the territory of the airports: aircraft engines, special vehicles, application of chemicals (used for cleaning, de-icing, etc); radio navigation equipment of airports and aircrafts; accidents (oil depots at airports, due to use of poor-quality, outdated equipment); private cars and taxis; stationary sources in the airport building (boiling houses, repair shops, cargo management and more).

3. The airport is rather large and complex engineering structure, so the influence on the abiotic components is quite significant, including destruction of soil, pollution of air, underground and surface water, noise, vibration and thermal pollution. The changes in physical environment have strong influence on the biota. The population living in the zones of the impact of airports also suffers from health effects.

4. During the study, the web-sites of Ukrainian and international airports were analyzed, as well as open-access information on the sites of regions of Ukraine regarding the environmental impact of airports, reports and development plans. The analysis shows that environmental policy is available and accessible for Boryspil International Airport, Odessa International Airport, Lviv International Airport and Dnepropetrovsk International Airport, while Zaporizhzhya Airport has only declared commitment to mitigation of environment impacts. The Kyiv (Zhulyany), Nikolaev, Kryvy Rih, Nikolaev International Airport, Ivano-Frankivsk Airport, Rivne International Airport, Sumy Airport, Uzhhorod Airport, Kharkiv Airport, Airport Chernivtsi, Poltava Airport, Ternopilaviaautotrans Company, Kherson Airlines, Vinnitsa Airport and Zhytomyr International Airport have no formulated environmental policy or any declared commitments.

5. Thus, analysis of environmental policy, reports, development plans, declarations and characteristics of Ukrainian airports shows that not all airports in the country have plans

for implementation of environmental measures and progressive environmental policy. Most businesses do not cover environmental information and documentation, or are not developing in the environmental field at all. Some airports with international status even do not have minimal information on their nature protection facilities, and some small businesses do not even have their own sites. Since most airports do not have environmental expertise reports, information about the enterprise and its environmental impact has only been found in regional reports, city environmental passports, student surveys and journalist articles.

6. For the analysis of the environmental performance of Ukrainian airports we have used the 3 grading parameters, which characterize planning and documentation of environment protection activities, violations of the nature protection legislation and presentation of environmental activity in mass media. The total results of the evaluation: 7 airports with positive efficiency; 5 with negative; 8 with zero efficiency. To improve the existing situation developed recommendations on the environmental documentation, regional nature protecting peculiarities and public participation organization for environment protection were developed.

7. Consequently, managers of more progressive (large) enterprises should continue to pursue environmental activities and strive for world-class results. The small business executives should pay more attention to environmental protection, surrounding areas, human health, and modernizing businesses, as this is not just about maintaining human health and resources, but it is also way to cost savings, status improvement and above all, respect and trust of people.

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